

# NASA TECH BRIEF

## *Langley Research Center*



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### Pressure Application Technique for High-Temperature Composite Fabrication

A new fabrication technique eliminates the requirement for precisely designed and machined matched metal-die tooling in forming complex composite shapes at high temperatures. This tooling is normally required in the manufacture of complex shapes of a composite such as graphite-reinforced P13-N polyimide resin, since the pressure requirements for P13-N consolidation exceed the capabilities of most production autoclaves.

In the new pressure application technique, the characteristic of room-temperature vulcanizing rubber (RTV) to expand readily when heated is utilized. If properly contained, this RTV expansion can be used to exert uniform pressure on filament-reinforced polymer materials during curing. This manufacturing technique has been used successfully to produce high-density, complex epoxy-composite shapes with a minimum of tooling. Normal processing temperatures for reinforced epoxies range from ambient up to approximately 350° F (180° C), while this technique can be used for applications requiring pressure introductions up to 600° F (320° C).

An extension of this technology to accommodate high-temperature pressure application for P13-N polyimide composite consolidation during cure has been made. A special, low-expansion, high-temperature RTV has been used to provide a uniform pressure of approximately 1000 psi ( $6.9 \times 10^6$  N/m<sup>2</sup>) at 600° F

for the fabrication of a graphite-reinforced P13-N polyimide contoured pan. Preliminary indications are that the reinforced pan has excellent dimensional tolerances with a high degree of consolidation. More importantly, the tooling required for this complex contoured pan is far simpler than that required for a matched metal-die-formed pan. The clearance requirements in the RTV-made mold method are minimal when compared to those for the matched metal-die approach.

#### Note:

No further documentation is available. Specific questions, however, may be directed to:

Technology Utilization Officer  
Langley Research Center  
Mail Stop 139-A  
Hampton, Virginia 23665  
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#### Patent status:

NASA has decided not to apply for a patent.

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